One-part piston for an internal combustion engine

The invention relates to a one-part piston for an internal combustion engine, in accordance with the preamble of claim 1.

A multi-part cooled piston having a cooling channel disposed in the edge region of the piston crown is known from the *Offenlegungsschrift* DE 40 39 751 A1, which is covered with a sheet-metal ring essentially configured like a plate spring. This sheet-metal ring is configured in one part and therefore can be assembled on the piston without problems, because the piston is structured in two parts. In this connection, it is necessary to first assemble the sheet-metal ring on the upper piston part, before the latter is connected with the lower piston part.

A one-part cooling channel piston having a cooling channel disposed in the edge region of the piston crown is known from the European patent EP 0 799 373 B1, which is also closed off with a cover ring configured like a plate spring. It is disadvantageous in this connection that this cover ring must be configured in two parts, in order to be able to be assembled. During assembly, each of the two ring halves in the shape of a semi-circle is individually introduced into corresponding supports on the piston head, in the biased state.

Proceeding from this, the invention is based on the problem of creating a cooling channel cover for a one-part piston of an internal combustion engine, which is easy to install.

The problem is solved with the characteristics contained in the characterizing part of the main claim. Practical embodiments of the invention are the object of the dependent claims.

An exemplary embodiment of the invention will be described in the following, using the drawings. These show

Fig. 1 a piston for an internal combustion engine, having a cooling channel that is closed off by a ring that essentially has a cylinder shape, according to the invention, represented in a sectional diagram that consists of two halves, which diagram shows two longitudinal sections of the piston offset by 90°,

Fig. 2 a section of the piston along the line A-A in Fig. 1,

Fig. 3 a partial section of the piston along the line C-C in Fig. 2, which shows an oil feed pipe for the introduction of cooling oil into the cooling channel,

Fig. 4 a partial section of the piston along the line B-B in Fig. 2 that shows the oil feed pipe snapped into the ring,

Fig. 5 an enlarged representation of the region "X" in Fig. 4, which shows the snap-in connection between the ring and the oil feed pipe,

Fig. 6 a top view of the ring with the oil feed pipe, and

Fig. 7 a perspective representation of the ring with the oil feed pipe.

Figure 1 shows a piston 1 for an internal combustion engine, configured in one piece, in a sectional diagram that consists of two halves, of which the left half shows a section of the piston 1 along a longitudinal axis 2 of a pin bore 3, and the right half shows a longitudinal section of the piston 1 offset by 90° relative to the former. The piston 1 is made of steel and has a combustion chamber bowl 5 in the region of the piston crown 4. In the radially outer region of the piston crown 4, a cooling channel 6 that runs around the circumference is disposed, the radially outer delimitation of which is formed by a ring wall 7 that is molded onto the piston crown 4, and the radially inner delimitation of which is formed partly by a ring rib 8, partly by a pin boss support 9, 9', and partly by a skirt connection 10, 10'. The ring wall 7 serves as a piston ring carrier in this connection.

Above the pin boss supports 9, 9', one pin boss 11, 11' with a pin bore 3, 3', in each instance, are each molded onto the piston crown 4. The faces 12 of the pin bosses 11, 11' are disposed set back relative to the ring wall 7, in the direction of the piston longitudinal axis 13. The pin bosses 11, 11' are connected with one another by way of skirt elements 14, 14', which are each

molded onto the piston crown 4 by way of a shaft connection 10, 10'. Between the skirt elements 14, 14' and the region 15 of the piston 1 on the piston crown side, the latter has recesses 16.

On the pin boss 11, 11', and on the shaft connection 10, 10' of the piston 1, respectively, a circumferential, nose-shaped projection 17 is affixed, the purpose of which consists in serving as a contact surface for an essentially cylindrical, one-part ring 18, by which the cooling channel 6 is closed off. The ring 18 can consist of plastic or of metal. On the inside 28 facing the piston longitudinal axis 13, the ring wall 7 has a circumferential groove 19, into which a collar 20 molded onto the outside of the ring 18 can be set, which collar is also circumferential and disposed on the piston crown side, thereby making it possible to attach the ring 18 on the inside of the ring wall 7. As is particularly evident in Figures 6 and 7, the ring 18 has a gap 22.

The assembly of the ring 18 can take place in simple manner, in that it is bent open and laid into the region of the piston 1 between ring wall 7 and skirt elements 14, 14'. Subsequent to this, the ring 18 is pressed together, so that its radius becomes smaller, whereby the lower edge of the ring 18, on the skirt side, comes to rest against the projection 17. Because the upper edge of the ring 18, on the piston crown side, is still pressed inward a little more, it is subsequently possible to push the

ring into the cooling channel 6 from below, so far that its collar 20 snaps into the groove 19 on the inside 28 of the ring wall 7, to fix the ring 18 in place.

An oil feed pipe 35 can be introduced into the gap 22, which consists of a funnel 21 with a pipe-shaped upper part 27, and which spreads the ring 18 when it is introduced. In this way, as particularly shown in Figures 4 and 5, it is reliably assured that the collar 20 of the ring 18 remains on the inside of the ring wall 7 even during fast back and forth movements of the piston 1 in the groove 19. The oil feed pipe 35 can consist of plastic or of metal.

The oil feed pipe 35, as shown in Fig. 3, is attached to the piston 1, in that a nose 23 affixed on the upper part 27 comes to rest on the upper edge of an opening 24 made close to the skirt 14, 14', after the oil feed pipe 35 has been introduced into the opening 24. Furthermore, the upper part 27, as Fig. 4, 5, and 7 show, has a circumferential groove 25 on its outside facing the piston crown, into which groove projections 26, 26' molded onto the inside of the ring 18 at its joints 29 and 30 snap when the oil feed pipe 35 is introduced into the opening 24, thereby attaching the oil feed pipe 35 on the ring 18.

In this connection, the groove 25 has a specific distance from the face 33 of the upper part 27 on the piston crown side, which

is sufficient so that, as shown in Figures 5 and 7, an excess length 34 of the upper part 27 results, so that the oil introduced into the cooling channel 6 does not immediately flow out of the cooling channel 6 again, through the upper part 27, and instead, is passed around the excess length 34 into the lower region of the cooling channel 6. The cooling oil can then flow off by way of an opening 36 (Fig. 7) affixed laterally on the ring 18.

Reference Symbol List

1	piston
2	longitudinal axis
3, 3'	pin bore
4	piston crown
5	combustion chamber bowl
6	cooling channel
7	ring wall
8	ring rib
9, 9'	pin boss support
10, 10'	skirt connection
11, 11'	pin boss
12	face of the pin boss 11, 11'
13	piston longitudinal axis
14, 14'	skirt element
15	region of the piston 1 on the piston crown side
16	recess
17	projection
18	ring
19	groove
20	collar
21	funnel
22	gap
23	nose
24	opening

25	groove
26, 26'	projection
27	upper part of the oil feed pipe 35
28	inside of the ring wall 7
29, 30	joints of the ring 18
33	face of the upper part 27
34	excess length of the upper part 27
35	oil feed pipe
36	opening of the ring 18